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(54) **Dehumidifier**

(57) The present invention relates to a dehumidifier, including a dehumidification rotor partitioned into a dehumidification area, which is dehumidified while indoor air passes through the dehumidification area, and a reconditioning area, which is reconditioned while reconditioning air passes through the reconditioning area, a plurality of heat exchange plates configured to perform heat exchange of indoor air before the indoor air has passed through the dehumidification rotor and reconditioning air which has passed through the dehumidification rotor, and

a reconditioning air distribution member placed between the reconditioning area of the dehumidification rotor and the heat exchange plates and configured to distribute the reconditioning air which has passed through the reconditioning area into the plurality of heat exchange plates. Accordingly, the dehumidification capability of a dehumidifier can be improved and noise, generated when a dehumidifier is driven, can be reduced.

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Description

Field of the Invention

[0001] The present invention relates to a dehumidifier and, more particularly, to a dehumidifier which is capable of making uniform the flow of fluid between a plurality of heat exchange plates by distributing and introducing reconditioning air into the plurality of heat exchange plates, thereby improving the condensing capability of the heat exchange plates and reducing noise generated by the flow of fluid.

Background of the Invention

[0002] In general, dehumidifiers can be classified according to their operation method as dehumidifiers using a cooling cycle and dehumidifiers using a desiccant rotor.

[0003] Dehumidifiers using a cooling cycle are problematic in that a compressor must be provided, and the compressor generates noise and occupies space. Accordingly, dehumidifiers using a desiccant rotor are more common nowadays.

[0004] The desiccant rotor has the property of absorbing moisture in the air and dehumidifies while transmitting indoor air therethrough. The desiccant which has absorbed the moisture is reconditioned using hot air.

[0005] The air that has been used to recondition the desiccant rotor has high temperature and high humidity and is discharged to the outside. Here a problem arises because the dehumidifier must be placed outside a building or, if placed indoors, an additional exhaust duct must be provided.

[0006] In the case where the hot, moist air that has reconditioned the desiccant is circulated within the dehumidifier, there is no need to provide the additional exhaust duct. There is another advantage in that the dehumidifier may be placed at a position desired by a user.

[0007] In order to circulate the hot, moist air, the moisture needs to be removed. Accordingly, a condensing heat exchanger for removing the moisture from the hot, moist air is generally provided in a space between an indoor air intake port and the desiccant rotor. That is, the humidity is lowered based on the principle that moisture within the hot, moist air is condensed through heat exchange between the hot, moist air and normal-temperature air.

[0008] Accordingly, in order to increase the heat exchange efficiency of the condensing heat exchanger, the shape of a duct within the condensing heat exchanger is very important. Accordingly, a plurality of heat exchange plates is used in order to increase the heat exchange area.

[0009] However, although the heat exchange area is increased using the plurality of heat exchange plates, the conventional condensing heat exchanger is problematic in that the flow of fluid within the condensing heat exchanger is not regular.

Summary of the Invention

[0010] It is, therefore, desirable to provide a dehumidifier which uniformly distributes reconditioning air into a plurality of heat exchange plates.

[0011] It is further desirable to provide a dehumidifier including a reconditioning air distribution member, which is capable of distributing and introducing reconditioning air into a plurality of heat exchange plates and also fixing the plurality of heat exchange plates.

[0012] In view of the above, a dehumidifier according to an exemplary embodiment of the present invention includes including a dehumidification rotor partitioned into a dehumidification area, which is dehumidified while indoor air passes through the dehumidification area, and a reconditioning area, which is reconditioned while reconditioning air passes through the reconditioning area, a plurality of heat exchange plates configured to perform heat exchange of indoor air before the indoor air has passed through the dehumidification rotor and reconditioning air which has passed through the dehumidification rotor, and a reconditioning air distribution member placed between the reconditioning area of the dehumidification rotor and the heat exchange plates and configured to distribute the reconditioning air which has passed through the reconditioning area into the plurality of heat exchange plates.

[0013] The details of other exemplary embodiments are included in the detailed description and the drawings.

[0014] The dehumidifier having the above construction according to the present invention has the following advantages.

[0015] First, reconditioning air is distributed and introduced into the plurality of heat exchange plates. Accordingly, there are advantages in that the condensing capability of the heat exchange plates can be improved and noise generated by the flow of the reconditioning air can be reduced.

[0016] Second, additional fastening means is not used in order to fix the plurality of heat exchange plates, and the plurality of heat exchange plates is fixed using the reconditioning air distribution member. Accordingly, there are advantages in that the number of parts can be reduced when the plurality of heat exchange plates is fixed, and a task process can be simplified.

Brief Description of the Drawings

[0017] The above and other features and advantages of the present invention will become more apparent from the following description of some exemplary embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a dehumidifier according to an exemplary embodiment of the present invention;

Fig. 2 is an exploded perspective view showing major

elements of the dehumidifier shown in Fig. 1;
 Fig. 3 is an exploded perspective view of a condensing heat exchanger, a reconditioning air distribution member, and a rotor frame according to the exemplary embodiment of the present invention;
 Fig. 4 is a front perspective view showing a state where the condensing heat exchanger and the reconditioning air distribution member of the present exemplary embodiment are coupled together;
 Fig. 5 is a rear perspective view of Fig. 4;
 Fig. 6 is a front view of the reconditioning air distribution member;
 Fig. 7 is a rear view of the reconditioning air distribution member;
 Fig. 8 is a left side view of the reconditioning air distribution member;
 Fig. 9 is a front perspective view of a heat exchange plate according to an exemplary embodiment of the present invention;
 Fig. 10 is a rear perspective view of the heat exchange plate according to the exemplary embodiment of the present invention; and
 Fig. 11 is a rear perspective view of the condensing heat exchanger.

Detailed Description of the Embodiments

[0018] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings so that they can be readily implemented by those skilled in the art. In describing the exemplary embodiments of the present invention, the same reference numbers are used throughout the drawings to refer to the same parts, and redundant descriptions thereof are omitted.

[0019] Fig. 1 is a perspective view of a dehumidifier according to an exemplary embodiment of the present invention, and Fig. 2 is an exploded perspective view showing major elements of the dehumidifier shown in Fig. 1.

[0020] The overall structure of the dehumidifier according to the exemplary embodiment of the present invention will be described with reference to Figs. 1 and 2.

[0021] The dehumidifier according to the exemplary embodiment of the present invention is configured to suck in indoor air, adsorb moisture from the indoor air, and discharge the dehumidified indoor air. To this end, a main body includes air intake units for sucking in air and an air discharge unit for dehumidifying and discharging the sucked-in indoor air. In the present exemplary embodiment, the air intake units are placed on the left and right sides of the main body and over the air discharge unit.

[0022] A front panel 8, the front surface of a bucket 10, left and right panels 4 and 6, an upper panel 2, a base 12, an upper rear panel 18, and a lower rear panel 16 constitute the external appearance of the main body.

[0023] The front panel 8 forms the external appearance

of the upper front portion of the main body. A groove on which a filter can be slidably mounted is formed in the rear surface of the front panel 8. The filter for purifying the indoor air passed through the air intake units is also placed in the front panel 8.

[0024] The left and right panels 4 and 6 form the side faces of the main body and include handles for enabling a user to manually move the dehumidifier.

[0025] A hole is formed at a position where the bucket 10 to be described later is placed, which belongs to the bottom of the side panels 4 and 6, so that an additional hose for discharging water, accommodated in the bucket 10, to the outside can be coupled to the hole.

[0026] The upper panel 2 forms the upper part of the main body. An air discharge unit, and a display unit and a manipulation unit for enabling a user to check the operation state of the dehumidifier and to input the operation of the dehumidifier are placed in the upper panel 2.

[0027] The rear panels 16 and 18 form the rear portion of the main body. In particular, the lower rear panel 16 is detachably coupled to the main body. A power code fixing unit (not shown) for fixing a power code, supplying electric power to the main body, is placed within the lower rear panel 16.

[0028] The base 12 forms the bottom of the main body. A wheel assembly is placed within the base 12. The wheel assembly includes a wheel for helping the movement of the dehumidifier and a wheel support to which the wheel is rotatably coupled. The top surface of the base 12 is open, and a drain fan 14 is placed on the top surface of the base 12. The bucket 10 is slidably and detachably coupled to the base 12.

[0029] A condensing heat exchanger 100, a rotor frame 43, a ventilator 20, and so on are placed over the drain fan 14. One or more holes through which condensed water, condensed in the condensing heat exchanger 100 and discharged therefrom, is discharged to the bucket 10 under the drain fan 14 are formed in the drain fan 14.

[0030] The bucket 10 forms a space for collecting the condensed water introduced via the drain fan 14. In the case where the bucket 10 is slidably coupled to the base 12 and condensed water is collected in the bucket 10, a user detaches the bucket 10 from the base 12 and empties it outside.

[0031] A ventilator 20, a dehumidification rotor 30, a reconditioning fan 50, a reconditioning air heating member 60, and the condensing heat exchanger 100 are placed within the main body.

[0032] The ventilator 20 sucks in indoor air through the air intake units and discharges the indoor air to the air discharge unit via the main body. The rear surface of the ventilator 20 is opened so that the ventilator 20 together with the upper rear panel 18 forms a ventilation duct. An air intake hole is formed in the front surface of the ventilator 20. An open outlet unit is formed on the top surface of the ventilator 20. A fan motor and a fan coupled to the rotation shaft of the fan motor are included within the

ventilator 20. An outlet grill may be placed in the air discharge unit.

[0033] The dehumidification rotor 30 functions to adsorb moisture in the indoor air sucked in by the ventilator 20 and to recycle the adsorbed moisture at low temperature. The dehumidification rotor 30 is placed between the ventilator 20 and the condensing heat exchanger 100.

[0034] The dehumidification rotor 30 includes a desiccant 35 and a desiccant wheel 33 to which the desiccant 35 is fixed. The desiccant 35 adsorbs moisture within the indoor air while the indoor air passes through the dehumidification rotor 30 and recycles the adsorbed moisture. The desiccant wheel 33 surrounds the circumference of the desiccant 35.

[0035] The desiccant 35 is generally configured to have a circular plate and is surrounded by the desiccant wheel 33. A fixing hole for fixing the desiccant 35 to the center of the dehumidification rotor 30 is formed in the desiccant 35.

[0036] The desiccant 35 may have a variety of shapes and materials. The desiccant 35 according to the present exemplary embodiment may have a shape in which paperboard and corrugated paper, made of ceramics fiber, are alternately wound up in a cylindrical shape. The desiccant 35 may also be made of meso-silica (SiO_2), such as nano-carbon balls (NCBs). NCBs have excellent hygroscopic properties owing to well-developed pores and surface area, and are capable of being reconditioned at a low temperature of about 60°C or less.

[0037] NCBs have a spherical carbon structure 200nm to 500nm in diameter that includes a spherical hollow core unit and a mesoporous carbon cell unit. NCBs include fine pores each having a diameter of 2nm to 50nm. The pores of typical activated carbon have a wide surface area (BET), a wide mesoporous area, and do not clog.

[0038] The desiccant 35 is partitioned into an area into which moisture within indoor air is absorbed while the indoor air passes through the desiccant 35 (hereinafter referred to as a 'dehumidification area'), and an area from which moisture evaporates into reconditioning air while the reconditioning air passes through the desiccant 35 (hereinafter referred to as a 'reconditioning area'). The respective areas alternate by rotation of the desiccant 35 so that moisture is absorbed and evaporated.

[0039] The reconditioning area generally has a fan shape. The reconditioning area is placed to face a reconditioning air heating member 60 to be described later.

[0040] The desiccant wheel 33 includes an edge unit configured to have a ring shape and to surround the circumference of the desiccant 35, a fixing unit configured to fix the desiccant 35, and a connection unit configured to connect the edge unit and the fixing unit and radially formed between the edge unit and the fixing unit.

[0041] A rotor supporter 41 for rotatably supporting the dehumidification rotor and a rotor frame 43 on which the rotor supporter 41 is mounted are placed within the main body.

[0042] A reconditioning air distribution member 90 to

be described later is coupled to the front face of the rotor supporter 41. The rear face of the reconditioning air distribution member 90 is opened. The rear face of the reconditioning air distribution member 90 is coupled to the rotor supporter 41 and is configured to form an intake unit 92 for sucking in the reconditioning air into the reconditioning air distribution member 90.

[0043] The rotor frame 43 partitions the inside of the main body into a rear space in which the ventilator 20 is placed and a front space in which the condensing heat exchanger 100 is placed. The front surface of the rotor frame 43 has an aperture formed therein, through which the indoor air and the reconditioning air passed through the desiccant 35 pass. An aperture unit 43a through which reconditioning air passed through an exhaust duct 80 to be described later passes is formed in the rotor frame 43.

[0044] A control box placement unit on which a control box 22 for controlling the dehumidifier is mounted is formed over the rotor frame 43.

[0045] The reconditioning fan 50 applies circulation force to induce circulation of reconditioning air within the main body. That is, the reconditioning fan 50 functions to suck in air passed through the exhaust duct 80 and discharge it to the reconditioning air heating member 60.

[0046] The reconditioning air heating member 60 heats the reconditioning air discharged from the reconditioning fan 50 and supplies hot reconditioning air to the dehumidification rotor 30. The reconditioning air heating member 60 includes heaters 63, a first heater cover 65 configured to cover the heaters 63 and communicate with the reconditioning fan 50, and a second heater cover 61 placed between the first heater cover 65 and the dehumidification rotor and coupled to the first heater cover 65.

[0047] The second heater cover 61 functions as a kind of air guide for preventing the air heated by the heaters 63 from leaking to the area between the heaters 63 and the dehumidification rotor 30 so that the air moves towards the dehumidification rotor.

[0048] Meanwhile, the reconditioning air, heated while passing through the reconditioning air heating member 60, is introduced into the reconditioning air distribution member 90 via the reconditioning area of the desiccant 35.

[0049] Fig. 3 is an exploded perspective view of a condensing heat exchanger, a reconditioning air distribution member, and a rotor frame according to the exemplary embodiment of the present invention, Fig. 4 is a front perspective view showing a state where the condensing heat exchanger and the reconditioning air distribution member of the present exemplary embodiment are coupled together, Fig. 5 is a rear perspective view of Fig. 4, Fig. 6 is a front view of the reconditioning air distribution member, Fig. 7 is a rear view of the reconditioning air distribution member, and Fig. 8 is a left side view of the reconditioning air distribution member.

[0050] A coupling relationship between the condensing heat exchanger 100 and the reconditioning air distri-

bution member 90 the construction of the reconditioning air distribution member are described with reference to Figs. 3 to 8.

[0051] The reconditioning air distribution member 90 is placed between the reconditioning area and a plurality of heat exchange plates 120, 140, and 160. Regenerated air passed through the reconditioning area is introduced into the reconditioning air distribution member 90 and is then distributed and introduced into the plurality of heat exchange plates 120, 140, and 160.

[0052] In the case where the heat exchange area of reconditioning air and indoor air is large, the heat exchange area of the reconditioning air and the indoor air is widened in the duct of the condensing heat exchanger 100 along which the reconditioning air flows. Accordingly, in the present exemplary embodiment, in order to increase the heat exchange area, the condensing heat exchanger 100 includes the plurality of heat exchange plates 120, 140, and 160 through which the reconditioning air flows. The plurality of heat exchange plates 120, 140, and 160 is arranged in parallel in a direction where the indoor air flows.

[0053] In the case where the plurality of heat exchange plates 120, 140, and 160 is arranged in parallel in the direction where the indoor air flows, the reconditioning air, introduced from a direction opposite to the direction where the indoor air flows, may be irregular in the amount introduced into each of the heat exchange plates 120, 140, and 160. In more detail, a great amount of the reconditioning air may be introduced into the heat exchange plate 160 close to the side into which the reconditioning air is introduced, and a small amount of the reconditioning air may be introduced into the heat exchange plate 120 far from the side into which the reconditioning air is introduced. Irregularity in the amount of the reconditioning air introduced into each of the heat exchange plates 120, 140, and 160 results in a reduction in the condensing capability of the condensing heat exchanger 100, the occurrence of noise in the flow of fluid within the condensing heat exchanger, and so on.

[0054] In the present invention, the reconditioning air distribution member 90 is configured to primarily accommodate the reconditioning air that has passed through the reconditioning area of the desiccant 35 and then to distribute the reconditioning air into each of the heat exchange plates 120, 140, and 160. Accordingly, the amount of the reconditioning air flowing through each of the heat exchange plates 120, 140, and 160 can become uniform as compared with the case where the reconditioning air passed through the reconditioning area is directly introduced into each of the heat exchange plates 120, 140, and 160.

[0055] The reconditioning air distribution member 90 of the present exemplary embodiment includes an intake unit 92 into which reconditioning air is introduced and discharge units 94 for distributing and discharging the reconditioning air into and to the heat exchange plates 120, 140, and 160.

[0056] The intake unit 92 is formed on the rear face of the reconditioning air distribution member 90. The rear face of the reconditioning air distribution member 90 is perforated. A part of the entire perforated area is shielded by a sealing unit 41a formed in the rotor supporter 41. Accordingly, the remaining area not shielded by the sealing unit 41a, which belongs to the entire perforated area, becomes the intake unit 92 into which the reconditioning air is introduced.

[0057] A part of the front face of the reconditioning air distribution member 90 is forward bent. Accordingly, a reconditioning air accommodation space 98 is formed between the front face and the rear face of the reconditioning air distribution member 90. The reconditioning air is temporarily accommodated in the reconditioning air accommodation space 98 and is then distributed and introduced into the condensing heat exchanger 100.

[0058] In particular, in the present exemplary embodiment, a portion to which the sealing unit 41a of the rotor supporter 41 is coupled, which belongs to the front face of the reconditioning air distribution member 90, is forward projected. In other words, the reconditioning air accommodation space 98 includes the front face 91 of the reconditioning air distribution member 90, which is forward projected, and the sealing unit 41a. That is, in the present exemplary embodiment, the reconditioning air accommodation space 98 is formed over the intake unit 92.

[0059] Accordingly, in the present exemplary embodiment, the sealing unit 41a is configured to seal the upper part of the opened rear face of the reconditioning air distribution member 90, and the intake unit 92 is formed on the lower part to which the sealing unit 41a is coupled.

[0060] The shape of the intake unit 92 may vary depending on the position and shape of the introduction units of the condensing heat exchange plate 100, the shape of the reconditioning area of the dehumidification rotor 30, and so on. In the present exemplary embodiment, it is illustrated that the intake unit 92 has a fan shape because the reconditioning area has the fan shape. Accordingly, the flow of reconditioning air, passed through the reconditioning area, into the reconditioning air distribution member 90 can become smooth.

[0061] Each of the discharge units 94 is formed in the reconditioning air accommodation space 98. Accordingly, reconditioning air that has passed through the intake unit 98 can be uniformly distributed into plurality of heat exchange plates 120, 140, and 160 through the reconditioning air accommodation space 98.

[0062] The discharge units 94 may be formed at various positions of the reconditioning air accommodation space 98. In the present exemplary embodiment, however, each of the discharge units 94 is formed in a circumferential portion between the front face 91 projected from the reconditioning air distribution member 90 and the sealing unit 41a. The number of discharge units 94 may correspond to the number of introduction units formed in each of the heat exchange plates 120, 140,

and 160. In the present exemplary embodiment, it is illustrated that two introduction units are formed in each of the heat exchange plates 120, 140, and 160 and two introduction units are also formed in the two discharge units 94.

[0063] In order for reconditioning air to uniformly flow through each of the heat exchange plates 120, 140, and 160, the discharge units 94 are formed in different directions. In more detail, in the present exemplary embodiment, one of the two discharge units 94 communicates with introduction units 122, 142, and 162 into which reconditioning air is introduced in a horizontal direction, and the other of the two discharge units 94 communicates with introduction units 124, 144, and 164 into which reconditioning air is introduced in a vertical direction.

[0064] Accordingly, the reconditioning air is introduced into the intake unit 92 and is then temporarily accommodated in the reconditioning air accommodation space 98 on the upper part. Some of the accommodated reconditioning air is discharged in a horizontal direction, and the remaining of the accommodated reconditioning air is discharged in a vertical direction. Accordingly, the flow of the reconditioning air in each of the heat exchange plates 120, 140, and 160 can become uniform, thereby being capable of increasing the condensing capability of the condensing heat exchanger 100 and also reducing noise.

[0065] The respective discharge units 94 are fit into the introduction units 122, 142, and 162 and the introduction units 124, 144, and 164 of the heat exchange plates 120, 140, and 160. In more detail, one of the two discharge units 94 is fit into the introduction units 122, 142, and 162 into which reconditioning air is introduced in a horizontal direction, and the other of the two discharge units 94 is fit into the introduction units 124, 144, and 164 into which reconditioning air is introduced in a vertical direction. Accordingly, the plurality of heat exchange plates 120, 140, and 160 can be fixed despite not using an additional fastening member. Further, reconditioning air can be prevented from leaking despite not using an additional sealing member between each of the discharge units 94 and the introduction units 122, 142, and 162 and the introduction units 124, 144, and 164 which communicate with each other through the fitting coupling.

[0066] Meanwhile, the reconditioning air distribution member 90 includes a temperature sensor for detecting the temperature of reconditioning air flowing through the reconditioning air distribution member 90. That is, an accommodation groove 96 where the temperature sensor is placed is formed in the reconditioning air distribution member 90. In the present exemplary embodiment, the accommodation groove 96 is placed in the front face of the intake unit 92. The dehumidifier of the present exemplary embodiment further includes a control unit for measuring a temperature of reconditioning air introduced into the intake unit 92 and, if the measured temperature is a specific temperature or more as a result of the measurement, turning off power source of the dehumidifier.

Accordingly, an electric leakage or fire, which may occur when the reconditioning air has a specific temperature or more, can be prevented.

[0067] The condensing heat exchanger 100 performs heat exchange of reconditioning air, passed through the reconditioning air distribution member 90, with indoor air. That is, the condensing heat exchanger 100 condenses reconditioning air into which moisture has been absorbed, while the reconditioning air passes through the reconditioning area of the dehumidification rotor 30, using the indoor air. The condensing heat exchanger 100 discharges the reconditioning air from which moisture has been removed to the reconditioning fan 50 through the exhaust duct 80. The condensed water is discharged to the drain fan 14.

[0068] Meanwhile, in the present exemplary embodiment, the condensing heat exchanger 100 includes the plurality of heat exchange plates 120, 140, and 160. The introduction units 122 and 124, 142 and 144, and 162 and 166 configured to communicate with the reconditioning air discharge units 94 and receive reconditioning air are formed in the respective heat exchange plates 120, 140, and 160.

[0069] As described above, the introduction units 122 and 124, 142 and 144, and 162 and 166 may be formed in various angles. In the present exemplary embodiment, however, the condensing heat exchanger 100 includes the introduction units 122, 142, and 162 into which reconditioning air is introduced in a horizontal direction and the introduction units 124, 144, and 164 into which reconditioning air is introduced in a vertical direction. The introduction units 122, 142, and 162 and the introduction units 124, 144, and 164 are fit into the respective discharge units 94 of the reconditioning air distribution member 90.

[0070] Each of the heat exchange plates 120, 140, and 160 includes reconditioning air ducts, indoor air ducts, and a discharge unit. The above elements formed in each of the heat exchange plates 120, 140, and 160 are common, and only heat exchange plate 120 is described below as an example.

[0071] Fig. 9 is a front perspective view of the heat exchange plate 120 according to an exemplary embodiment of the present invention, and Fig. 10 is a rear perspective view of the heat exchange plate 120 shown in Fig. 9.

[0072] Referring to Figs. 9 and 10, a discharge unit 134 is an exit from which reconditioning air, subject to heat exchange with indoor air while the reconditioning air passes through the heat exchange plate 120, is discharged. The discharge unit 134 may be placed in various positions of the heat exchange plate 120.

[0073] In the present exemplary embodiment, the discharge unit is formed on one side of the lower circumferential portion of the heat exchange plate 120. Accordingly, a distance where reconditioning air introduced through the introduction units 122 and 124 on the upper part of the heat exchange plate 120 flows is increased, thereby

being capable of increasing the heat exchange time and area.

[0074] In the case where the discharge unit 134 is placed on one side of the right and left sides of the lower circumferential portion, there is an advantage in that the size of the entire dehumidifier can be slimmed.

[0075] Reconditioning air duct 126 are ducts through which reconditioning air placed between the introduction units 122 and 124 and the discharge unit 134 passes. The reconditioning air is subject to heat exchange with indoor air while passing through the reconditioning air ducts 126. The reconditioning air ducts 126 in the present exemplary embodiment include a plurality of pipes formed in the upper and lower directions of the heat exchange plates. In other words, the reconditioning air ducts 126 are vertically formed so that air introduced through the introduction units 122 and 124 formed on the upper part of the heat exchange plate 120 can be easily discharged to the discharge unit 134 formed on the lower part thereof. Indoor air ducts 128 to be described later are formed between the plurality of respective pipes.

[0076] In the case where the discharge unit 134 is placed on one side of the right and left sides of the circumferential portion of the heat exchange plate 120 as described above, a distance between the introduction unit 122 and the discharge unit 134 differs from a distance between the introduction unit 124 and the discharge unit 134. In this case, a distance where air passed through the introduction unit 122 flows through the heat exchange plate 120 is different from a distance where air passed through the introduction unit 124 flows through the heat exchange plate 120. Accordingly, imbalance may be generated in the flow of reconditioning air, introduced into the heat exchange plate 120, within the heat exchange plate.

[0077] A distribution unit 130 and the reconditioning air ducts 126 for solving imbalance in the flow according to the present exemplary embodiment are described below.

[0078] The distribution unit 130 is formed between the introduction unit 124, which is close to the discharge unit 134 as compared with the introduction unit 122, and the discharge unit 134. The distribution unit 130 functions to distribute the flow of reconditioning air and also slow the flow velocity of the reconditioning air. In more detail, the distribution unit 130 includes baffles having various shapes which are formed in a space between the introduction unit 124, which is relatively close to the discharge unit 134 as compared with the introduction unit 122, and the discharge unit 134 (hereinafter referred to as a 'dispersion space'). In other words, in the present exemplary embodiment, the distribution unit 130 includes a plurality of circular baffles formed in the dispersion space.

[0079] An indoor air duct 130a through which indoor air can pass may be formed in each of the circular baffles. Accordingly, there is an advantage in that reconditioning air passed through the dispersion space can be condensed because the indoor air can flow through the in-

door air ducts 130a formed in the dispersion space.

[0080] Meanwhile, the distribution unit 130 may be placed on the portion of the introduction unit 124, which belongs to the space between the introduction unit 124 and the discharge unit 134. Accordingly, the distribution unit 130 may function to slow the velocity of reconditioning air introduced through the introduction unit 124 and also diversify the flow of the reconditioning air introduced through one introduction unit 124. In other words, the reconditioning air passing through one introduction unit 124 may be variously distributed into the plurality of reconditioning air ducts 126, thereby being capable of making smooth the flow of the reconditioning air within the heat exchange plate 120.

[0081] It has been described above that, in the present exemplary embodiment, the distribution unit 130 is placed on the part of the introduction unit 124, which is close to the discharge unit 134 as compared with the introduction unit 122. However, in the case where the distribution unit 130 is placed close to the introduction unit 122 or 124 irrespective of a distance from the discharge unit 134, air introduced through the introduction unit 122 or 124 can be distributed into the plurality of reconditioning air ducts 126.

[0082] Meanwhile, the reconditioning air ducts 126 placed between the introduction unit 122 or 124, which is close to the discharge unit 134, and the discharge unit 134 may be tilted at a specific angle in a vertical direction. Alternatively, a part of the reconditioning air ducts in the upper and lower directions may be bent. In this case, the equilibrium in the discharge time between reconditioning air introduced from the introduction unit 122, which is relatively far from the discharge unit 134 as compared with the introduction unit 124, and reconditioning air introduced from the introduction unit 124 can be maintained. A sufficient heat exchange time between the reconditioning air passing through the reconditioning air ducts 126 and indoor air can also be secured because the velocity of the reconditioning air becomes slow.

[0083] In more detail, in the present exemplary embodiment, reconditioning air ducts 126a placed under the dispersion space are tilted toward the discharge unit 134. In this case, indoor air ducts 128a placed between the respective tilted reconditioning air ducts 126a are also tilted. Accordingly, the time that it takes to discharge the reconditioning air can be extended because the distance where the reconditioning air moves is increased as compared with the case where the reconditioning air ducts 126a are vertically placed.

[0084] Reconditioning air ducts 126b that are partially bent in the upper and lower directions function to bend the flow of reconditioning air flowing downward in a vertical direction, thereby reducing the velocity of the reconditioning air. In more detail, in the present exemplary embodiment, the bent reconditioning air ducts 126b are placed under the tilted reconditioning air ducts 126a.

[0085] The reconditioning air ducts 126b may be bent in various directions. In the present exemplary embodi-

ment, however, the reconditioning air ducts 126b are bent in a direction where indoor air flows. The cross area of each of the reconditioning air ducts 126b after the bending may be greater than that of each of the reconditioning air ducts 126 before the bending. Accordingly, the heat exchange area between the bent reconditioning air ducts 126b and indoor air ducts 128b placed between the bent reconditioning air ducts 126b is wider than the heat exchange area between the tilted reconditioning air ducts 126a and the indoor air ducts 128a placed between the tilted reconditioning air ducts 126a.

[0086] Further, the cross areas of the plurality of reconditioning air ducts 126 that are vertically formed may be decreased toward the discharge unit 134. In other words, a small amount of reconditioning air flows into the reconditioning air ducts 126 close to the discharge unit 134, and a relatively great amount of reconditioning air flows into the reconditioning air ducts 126. Accordingly, imbalance in the flow of reconditioning air, which may occur because the discharge unit 134 is formed on one side of the heat exchange plate 120, can be prevented.

[0087] Meanwhile, baffle ducts 127 for reducing the flow velocity of reconditioning air may be formed in the right and left directions between all the reconditioning air ducts 126 of the heat exchange plate 120. Accordingly, the time that it takes to perform heat exchange between the reconditioning air flowing through the reconditioning air ducts 126 and indoor air can be increased by reducing the velocity of the reconditioning air.

[0088] The indoor air ducts 128 are formed between the plurality of respective reconditioning air ducts 126 of the heat exchange plate 120 so that the indoor air ducts 128 transmit indoor air therethrough. In this case, reconditioning air flowing through the reconditioning air ducts 126 is subjected to heat exchange with the indoor air. The moisture of reconditioning air, which has been absorbed to the reconditioning air while the reconditioning air passes through the reconditioning area of the desiccant 130, is removed using indoor air by condensed the reconditioning air.

[0089] The indoor air ducts 128 are lengthily perforated in a vertical direction between the respective reconditioning air ducts 126. The indoor air ducts 126a placed between the respective tilted reconditioning air ducts 126a as described above are also tilted at a specific angle in a vertical direction. Accordingly, each of the indoor air ducts 126 has a wide area where heat exchange with reconditioning air is performed, as compared with the indoor air ducts 126.

[0090] As described above, the distribution unit 130 may be perforated in order to further form the indoor air ducts 130a.

[0091] A discharge hole 132 from which condensed water condensed from reconditioning air is discharged is further formed at the bottom of the heat exchange plate 120. The condensed water discharged through the discharge hole 132 is accommodated in the bucket 10 via the drain fan 14.

[0092] Fig. 11 is a rear perspective view of the condensing heat exchanger 100.

[0093] A coupling relationship between the condensing heat exchanger 100 and the reconditioning air distribution member 90 is described below with reference to Fig. 11. The rear face of the condensing heat exchanger 100 is shown to have a plane shape, but a part of the rear face may be forward depressed (a first depression portion). The plurality of heat exchange plate 120, 140, and 160 generally has a square shape, but a part of them may have a depressed shape. In the present exemplary embodiment, portions where the introduction units 122, 124, 142, 144, 162, and 164 are formed are depressed (a second depression portion).

[0094] As described above, a part of the front face of the reconditioning air distribution member 90 is projected, and the projected front face 91 is placed in the second depression portion. A portion that has not been projected, which belongs to the front face of the reconditioning air distribution member 90, is brought in contact with the first depression portion and is coupled thereto. If the condensing heat exchanger 100 is coupled to the reconditioning air distribution member 90, the first depression portion and the second depression portion are filled with the reconditioning air distribution member 90. Accordingly, the entire dehumidifier can be slimmed and reduced in weight.

[0095] A process of condensing reconditioning air and a process of dehumidifying indoor air in the dehumidifier constructed above according to the present invention are described below.

[0096] First, reconditioning air circulates through the reconditioning ducts when the reconditioning fan 50 is rotated. That is, the reconditioning air passed through the reconditioning fan 50 is heated in the reconditioning air heating member 60, thereby having a high temperature. The reconditioning air of a high temperature reconditions the reconditioning area of the dehumidification rotor 30 and is sucked in by the intake unit 92 of the reconditioning air distribution member 90.

[0097] The reconditioning air flows into the reconditioning air accommodation space 98 on the upper part of the intake unit 92 and enters the condensing heat exchanger 100 through the two discharge units 94.

[0098] The reconditioning air introduced into the condensing heat exchanger 100 is subject to heat exchange with indoor air while flowing up and down each of the heat exchange plates 120, 140, and 160. During the heat exchange process, moisture within the reconditioning air is condensed. The condensed moisture is discharged from the condensing heat exchanger 100 and is then accommodated in the bucket 10 via the drain fan 14.

[0099] The condensed reconditioning air is again introduced into the reconditioning fan 50 via the exhaust duct 80 and the aperture unit 43a of the rotor frame 43. That is, the reconditioning air circulates through the inside of the main body according to the above cycle.

[0100] Meanwhile, indoor air is sucked in by the air

intake unit of the main body. The suck-in indoor air is subject to heat exchange with the reconditioning air flowing through the reconditioning air ducts, while passing through the indoor air ducts of the condensing heat exchanger 100. The indoor air that has passed through the condensing heat exchanger 100 has moisture absorbed therein while passing through the dehumidification area of the desiccant 35 and is then dehumidified. The indoor air into which the moisture has absorbed passes through the blower fan 20 and is then discharged to the interior of a room through the air discharge units of the main body.

[0101] While the present invention has been shown and described in connection with the exemplary embodiments thereof, those skilled in the art will appreciate that the present invention may be changed and modified in various ways without departing from the scope of the present invention as defined in the following claims.

Claims

1. A dehumidifier, comprising:

a dehumidification rotor partitioned into a dehumidification area, which is dehumidified while indoor air passes through the dehumidification area, and a reconditioning area, which is reconditioned while reconditioning air passes through the reconditioning area;

a plurality of heat exchange plates configured to perform heat exchange of indoor air before the indoor air has passed through the dehumidification rotor and reconditioning air which has passed through the dehumidification rotor; and a reconditioning air distribution member placed between the reconditioning area of the dehumidification rotor and the heat exchange plates and configured to distribute the reconditioning air which has passed through the reconditioning area into the plurality of heat exchange plates.

2. The dehumidifier of claim 1, wherein:

the reconditioning air distribution member comprises an intake unit for sucking in the reconditioning air, and

the intake unit has a shape corresponding to a shape of the reconditioning area of the dehumidification rotor.

3. The dehumidifier of claim 1, wherein:

the reconditioning air distribution member comprises a plurality of discharge units for discharging the reconditioning air to the heat exchange plates, and each of the heat exchange plates comprises a

plurality of introduction units configured to communicate with the plurality of respective discharge units.

4. The dehumidifier of claim 3, wherein the discharge units of the reconditioning air distribution member are fit into the introduction units of each of the heat exchange plates, configured to communicate with the respective discharge units.

5. The dehumidifier of claim 3, wherein the plurality of discharge units is spaced apart from each other so that the reconditioning air is discharged from the discharge units in different directions.

6. The dehumidifier of any preceding claim, wherein a temperature sensor for detecting a temperature of the reconditioning air is placed in the reconditioning air distribution member.

7. The dehumidifier of claim 1, wherein a reconditioning air accommodation space for accommodating the reconditioning air which has passed through the reconditioning area, before the reconditioning air has been distributed into the plurality of heat exchange plates, is formed in the reconditioning air distribution member.

8. The dehumidifier of claim 7, wherein:

at least part of a front face of the reconditioning air distribution member is forward projected, and the reconditioning air accommodation space is formed in the rear of the projected front face.

9. The dehumidifier of any preceding claim, wherein:

a first depression portion which is forward depressed is formed in part of a rear face of each of the heat exchange plates, and at least part of a front face of the reconditioning air distribution member is configured to come in contact with the first depression portion.

10. The dehumidifier of any preceding claim, wherein:

a second depression portion which is depressed is formed in part of a circumferential portion of each of the heat exchange plates, and at least part of a front face of the reconditioning air distribution member has the same depressed portion as the second depression portion.

FIG. 1

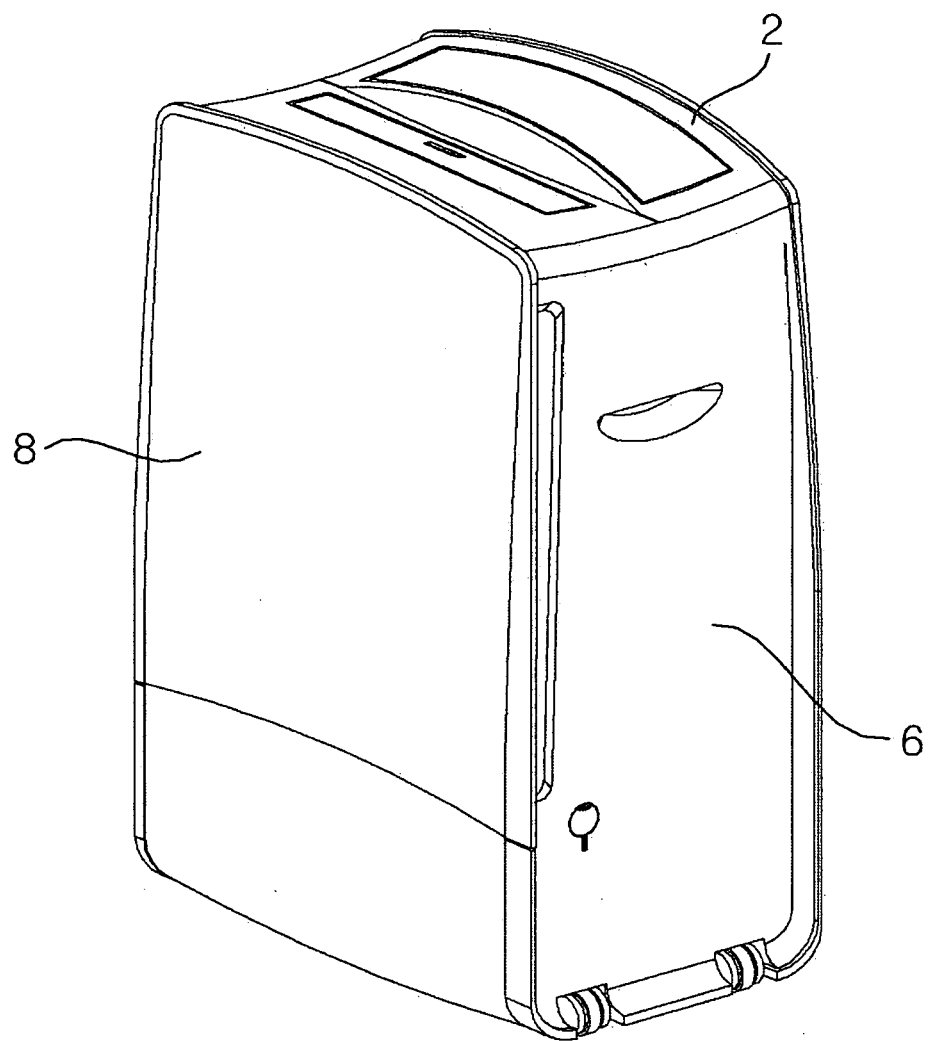


FIG. 2

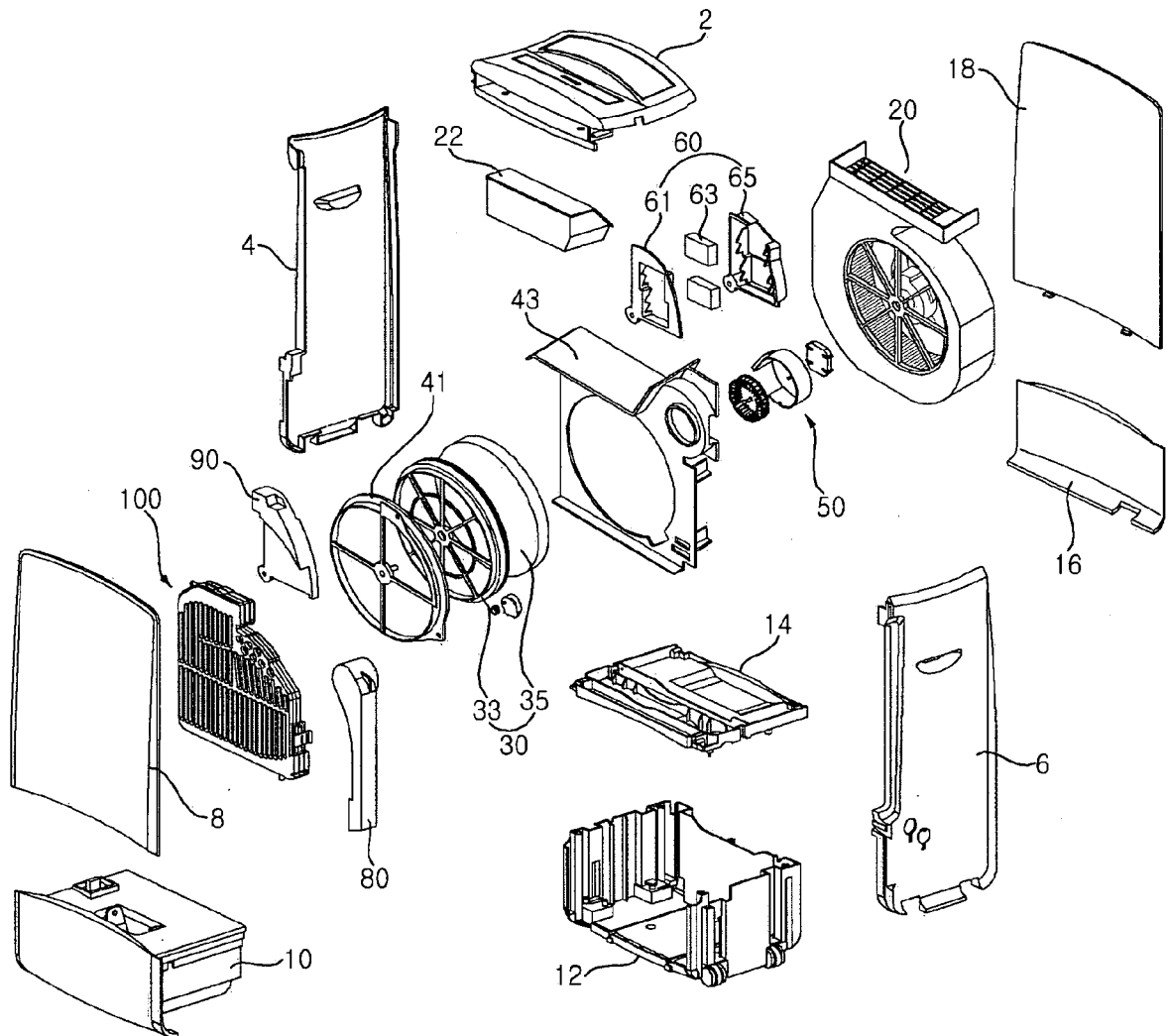


FIG. 3

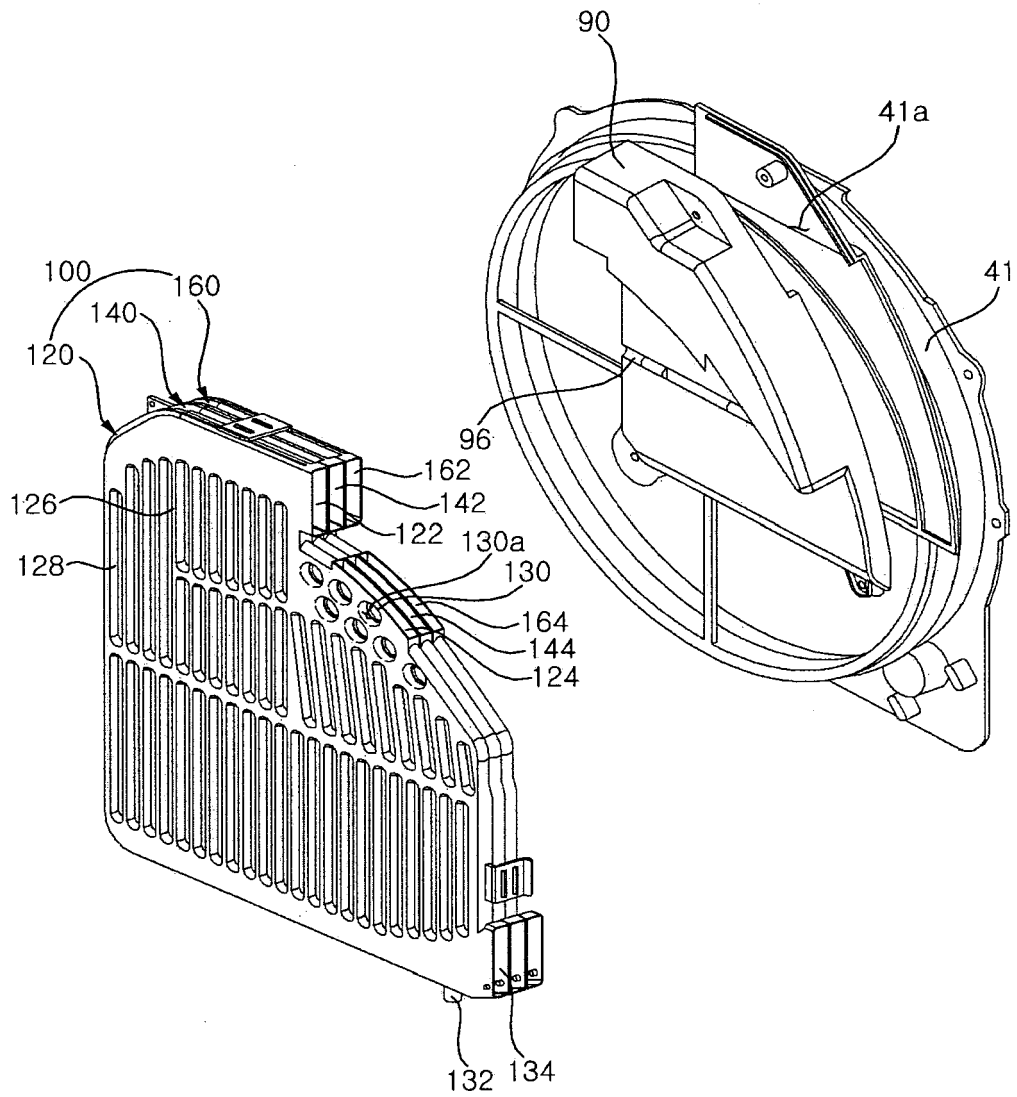


FIG. 4

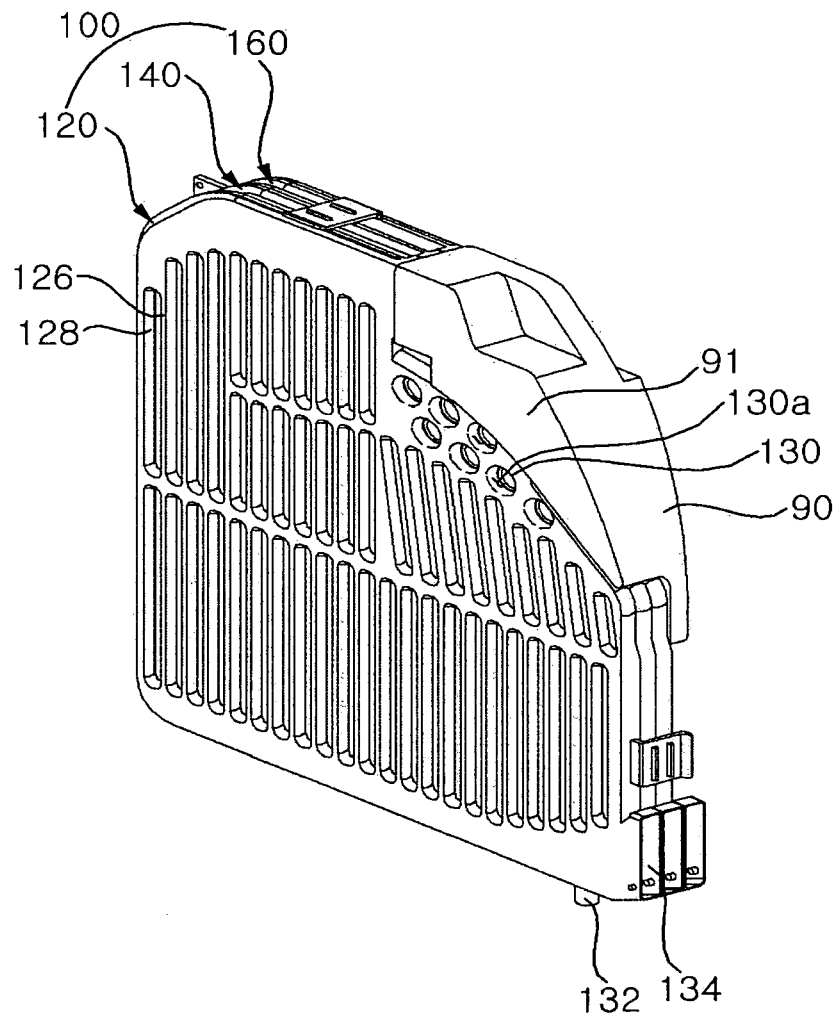


FIG. 5

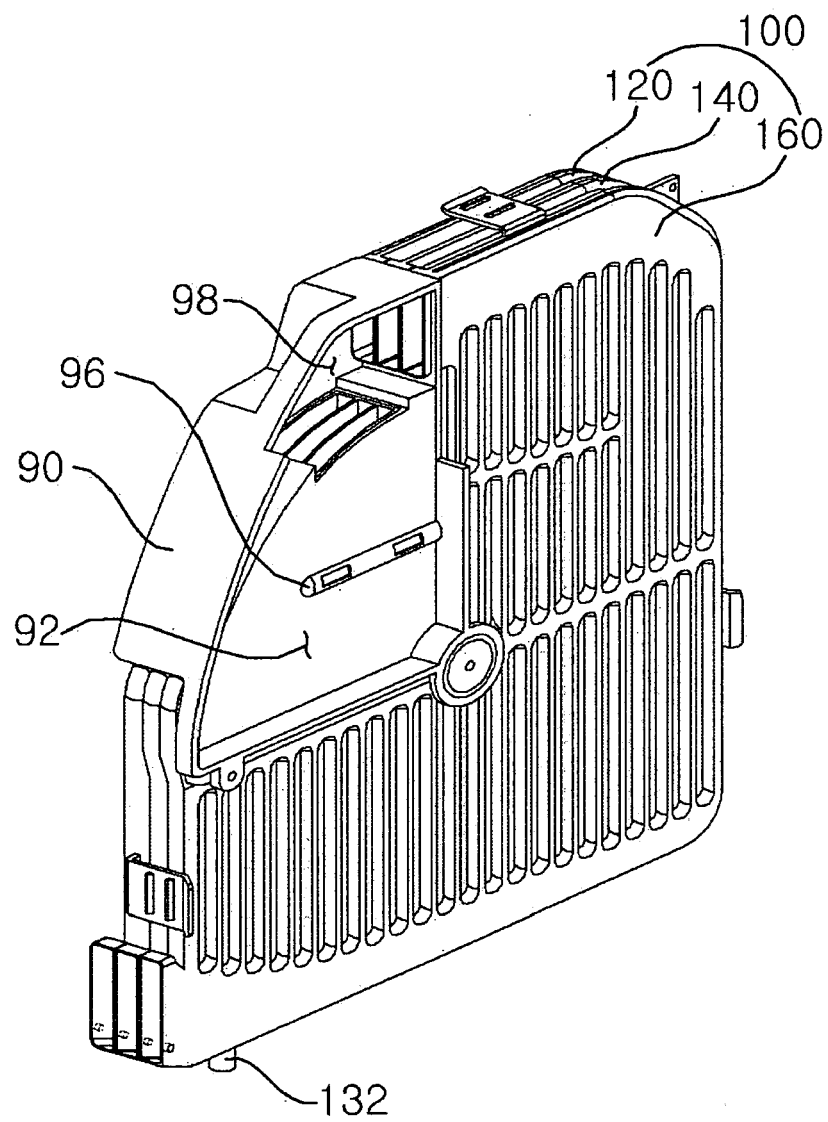


FIG. 6

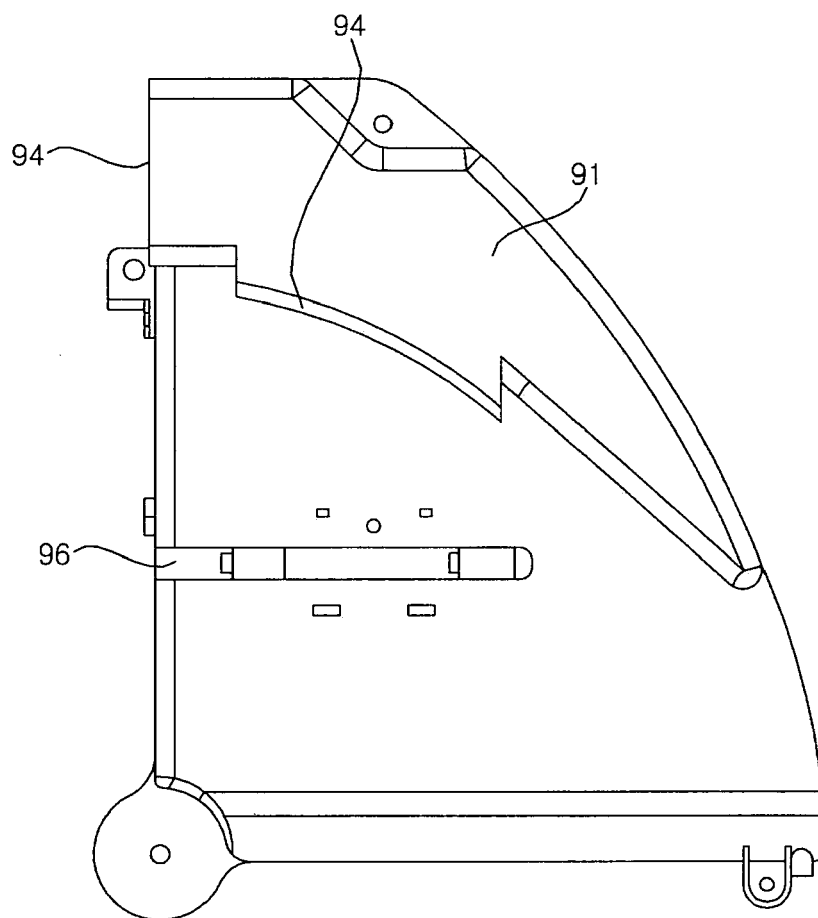


FIG. 7

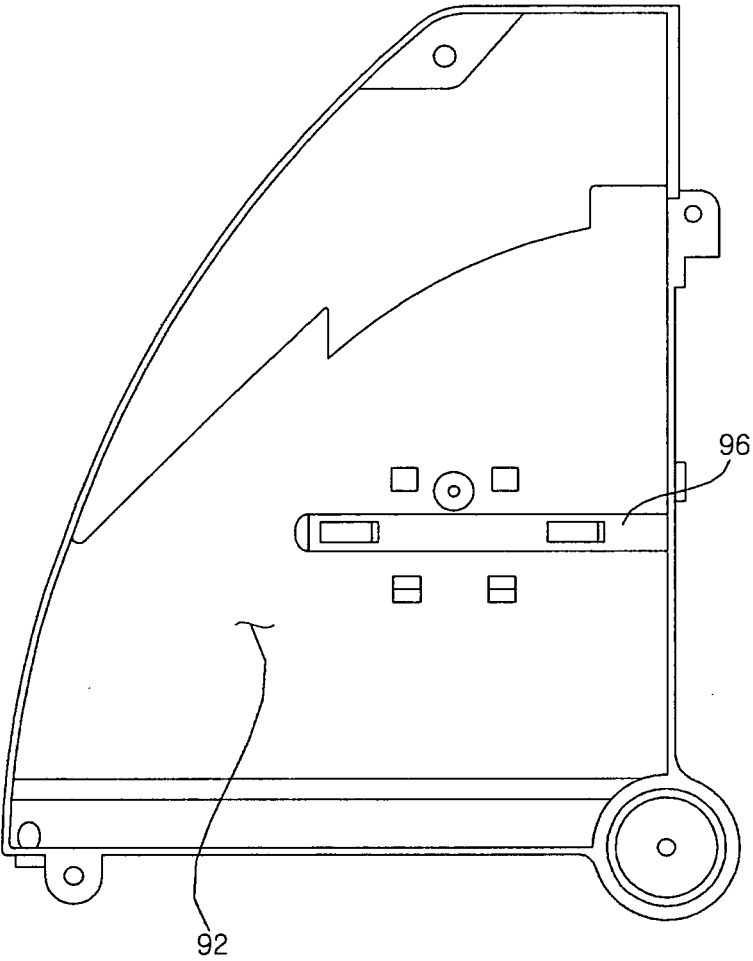


FIG. 8

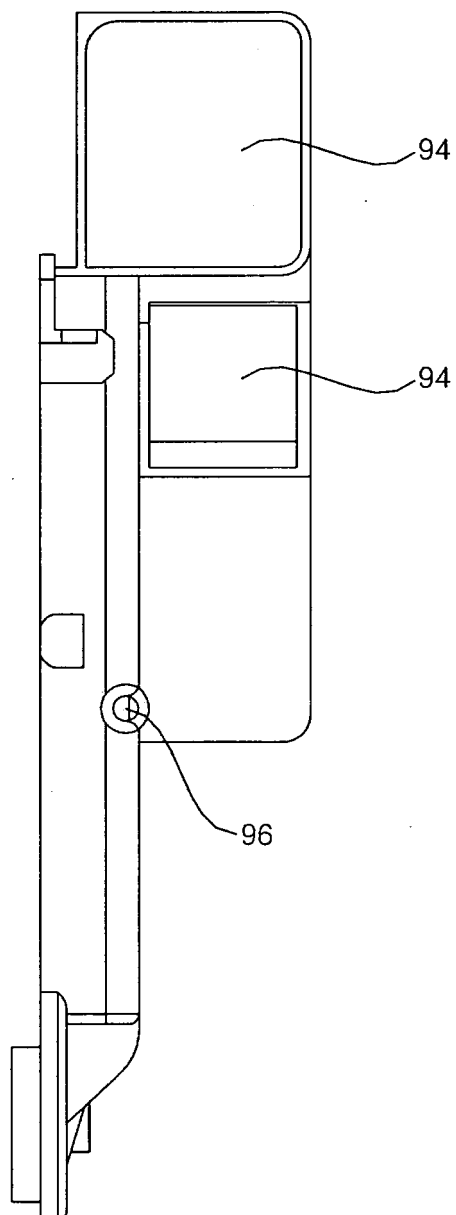


FIG. 9

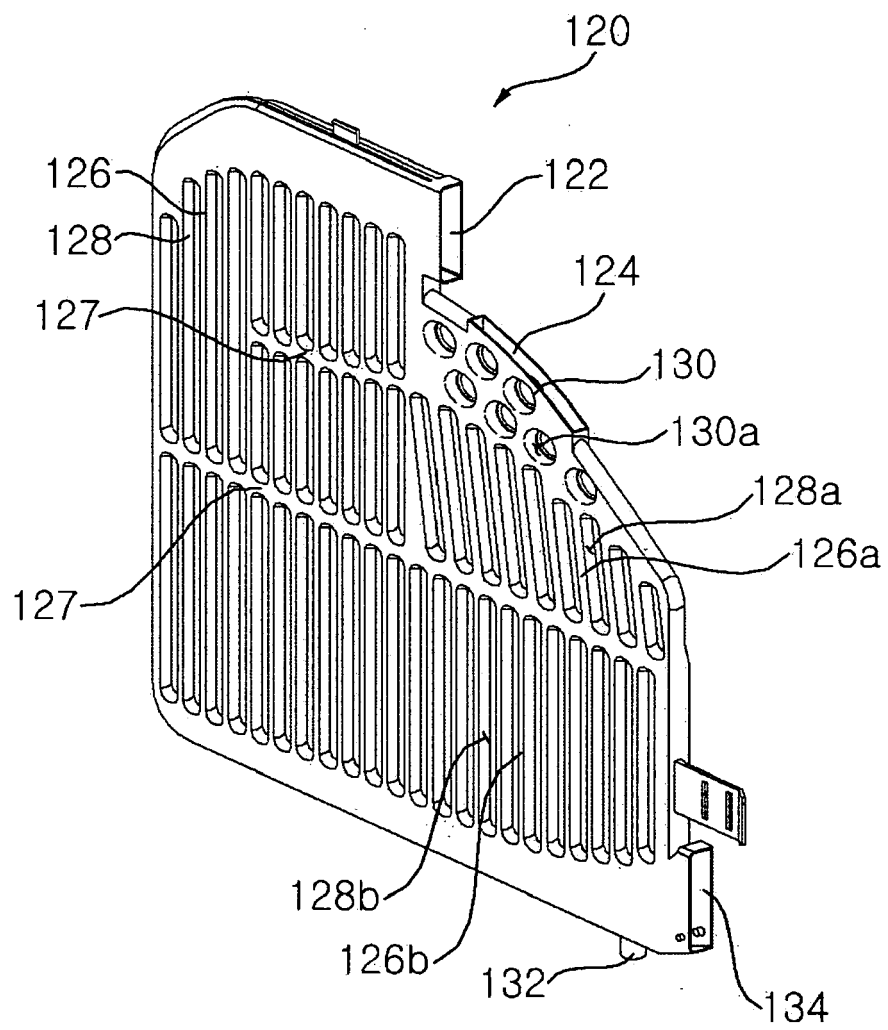


FIG. 10

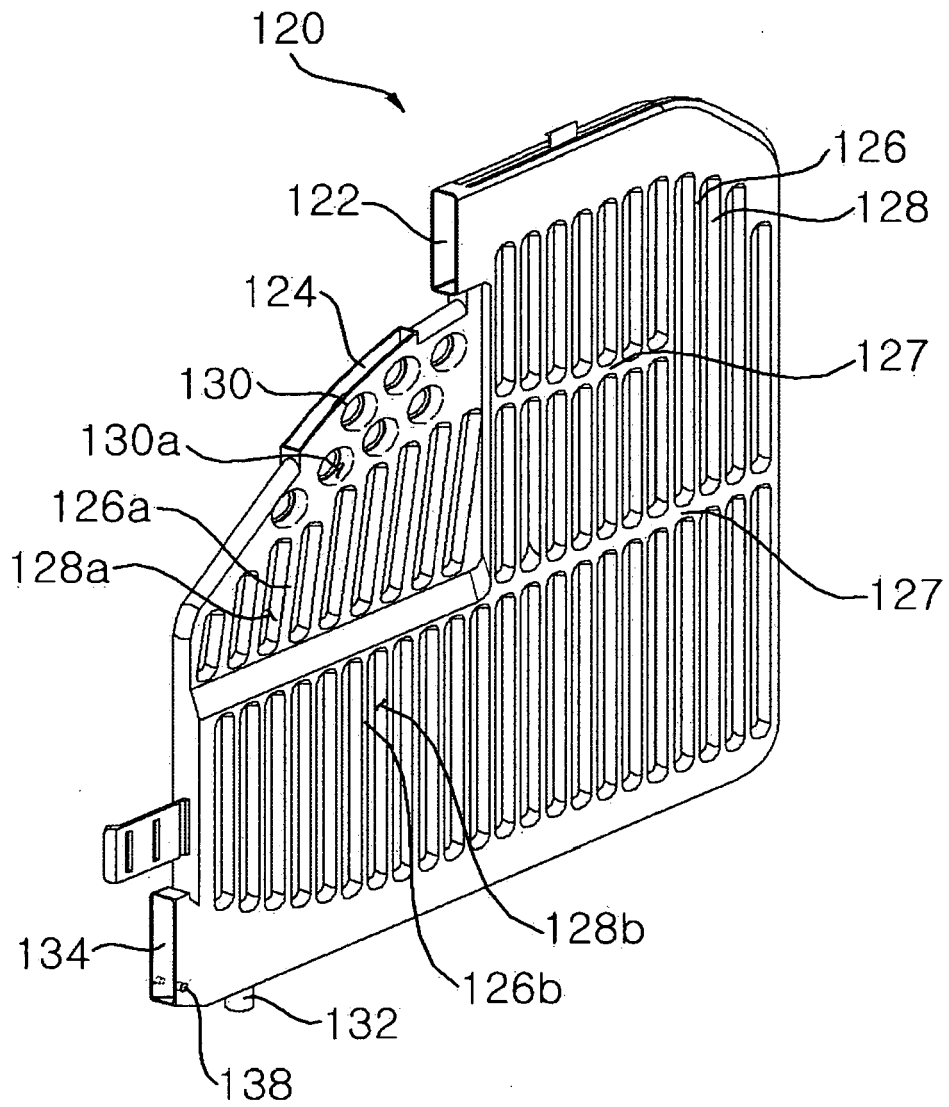


FIG. 11

